NASA SBIR/STTR Technologies

12-1 S1.08-9813 Volcanic Ash Detection Using Raman LIDAR: "VADER"

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Identification and Significance of Innovation

Volcanic ash is a significant hazard to aircraft engine and electronics and has caused damage to unwary aircraft and disrupted air travel for thousands of travelers, costing millions of dollars. Michigan Aerospace Corporation (MAC) proposes a Raman Light Detection and Ranging (LIDAR) system to obtain real-time information from volcanic ash clouds, to be named VADER. The instrument will be designed to operate from an airborne platform & will be compact and light weight. This approach benefits from returning realtime measurements, in contrast to sampling methods (impactors) that require postmission analysis.

Expected TRL Range at the end of Contract: 3
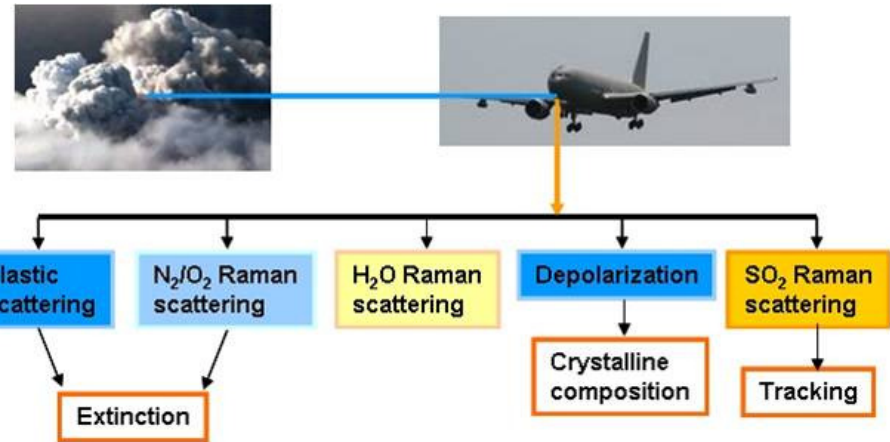
Technical Objectives and Work Plan

Technical Objectives:

1) Determine the operational envelope of the sensor and the resulting requirements.
2) Perform trade studies and photon budgets using models to determine the design parameters of the instrument.
3) Design the instrument for fabrication in Phase 2.

Work Plan:

Task 1: Requirements Definition: Define all instrument requirements and flow down.

Task 2: Sensor Performance Trade Studies: Model the instrument for transmitter and receiver size, and determine photon budget and SNR.

Task 3: System Design: Components selection and mechanical layout. Selection of opto-electronics components.

Task 4: Demonstration Plan for Phase II: Design plan to demonstrate the instrument performance.

NASA and Non-NASA Applications

NASA: An airborne volcanic ash detection/characterization system will have wide applications in the study of the threat volcanic ash poses to aircraft and for other scientific study of volcanic plumes. It will allow NASA to study airborne volcanic ash and provide data required to refine models of ash distribution. Combination with MAC's optical air data and turbulence-detection systems would produce a unified hazard/air data system.

Non-NASA: Other civil (NOAA, FAA, etc.) and military (US Air Force, etc.) organizations will have similar uses for this technology as NASA for scientific study. Also, VADER could serve to determine if a given airway is safe enough for civil or military aircraft to use during an eruption, allowing aviation to continue and be re-routed as needed.

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NON-PROPRIETARY DATA